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U.S. DEPARTMENT of TRANSPORTATION

Federal Aviation Administration

Interface Requirements Document (DRAFT)

National Airspace System (NAS) Voice System (NVS) to
Analog Interphone Interface

INTERFACE REQUIREMENTS DOCUMENTS
APPROVAL SIGNATURE PAGE

NVS to Analog Interphone Interface

APPROVAL SIGNATURES		
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REVISION LETTER	DESCRIPTION	DATE	ENTERED BY

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1. SCOPE

1.1 Scope

This Interface Requirements Document (IRD) is prepared in accordance with documents FAA-STD-067 and FAA-STD-025. This IRD provides the requirements for the interface between the National Airspace System (NAS) Voice System (NVS) and the legacy NAS Voice Switches using Ground to Ground (G/G) trunks that support analog interphone (I/P) call processing.

The design characteristics of the types of trunks that support this analog interphone interface will be captured by the contractor in the NVS to Analog Interface Control Document (ICD).

Section 2.0 lists the reference documents used in developing this IRD.

Section 3.0 defines the interfaces in terms of their general, functional, and physical characteristics.

Section 4.0 defines the Quality Assurance provisions for this IRD.

Section 5.0, Preparation for delivery, is not applicable in this IRD.

Section 6.0, Notes, contains definitions, abbreviations and acronyms used in this IRD.

1.2 Subsystem responsibility list

The following subsystems are affected by this IRD:

Table 1-1 Subsystem Equipment Responsibility

Subsystem/ Equipment	Common Name	Responsible Organization
NVS	NAS Voice System	AJW-92
VSCS	Voice Switching and Control System	AJW-92
TVS	Terminal Voice Switch	AJW-92

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2. APPLICABLE DOCUMENTS

Unless otherwise specified, the following documents of the issue in effect on the date of this IRD form a part of this IRD to the extent specified herein. In the event of conflict between the documents referenced herein and the contents of this IRD, the contents of this IRD shall be the superseding requirements.

2.1 Government documents

2.1.1 Federal Aviation Administration (FAA)

2.1.1.1 Standards

FAA-STD-067	Preparation of Specifications, December 4, 2009
FAA-STD-025F	Preparation of Interface Documentation, November 30, 2007
FAA-STD-054	Use of Selective Signaling Standard for Voice Communication Systems, March 12, 1996

2.1.1.2 Handbooks

None

2.1.1.3 Specifications

FAA-E-NVS	Federal Aviation Administration Procurement Specification, National Airspace System (NAS) Voice System (NVS), Draft

2.1.1.4 FAA Orders

None

2.1.1.5 Other FAA documents

DTFA01-02-D-03006	U.S. Department of Transportation, Federal Aviation Administration, Baseline for FAA Telecommunications Infrastructure (FTI), Attachment J.1, FAA Telecommunications Services Description (FTSD), August 2, 2007
HDDD-HWCI-2	Switching Subsystem Hardware Detailed Design Document for the Voice Switching and Control System (VSCS), 2 November 1998
HDDD-HWCI-7	System Interconnect Subsystem (SIS) Hardware Detailed Design Document for the Voice Switching and Control System (VSCS), 2 November 1998
NAS-IC-44010002	VSCS to the Transmission Equipment (Analog Interface) Interface Control Document for the Voice Switching and Control System (VSCS), 2 November 1998

NAS-IR-nnnnnnnn U.S. Department of Transportation, Federal Aviation Administration, Interface Requirements Document (DRAFT), NVS to FAA Telecommunications Infrastructure (FTI), June 6, 2010 DRAFT

2.1.2 Military Documents

None

2.2 Non-Government documents

2.2.1 Standards

ANSI/TIA-464C Telecommunications Multiline Terminal Systems requirements for Private Branch Exchange (PBX) Switching Equipment (October 2002 with Addendum 1 June 2004)

2.2.2 Other publications

2.2.2.1 Telcordia Technologies

PUB 43001 Bell System Transmission Engineering Technical Reference, Functional Criteria - Voice Frequency Terminating Equipment Metallic Facilities Central Office, November 1982

PUB 43201A Bell System Transmission Engineering Technical Reference, Private Line Interconnection (Voice Applications), June 1970, with Revision A dated December 1981

2.3 Document Sources

2.3.1 Source of FAA Documents

Copies of FAA specifications, standards, and publications may be obtained from the contracting officer, Federal Aviation Administration, 800 Independence Ave., S.W., Washington, DC 20591.

2.3.2 Source of ANSI/TIA/EIA Documents

Copies of TIA/EIA specifications, standards, and publications may be obtained from the Standards and Technology Department of the Telecommunication Industry Association, 2500 Wilson Boulevard, Arlington, Virginia 22201.

2.3.3 Source of Telcordia Technologies Documents

Publications issued by the Western Electric Company (WECO), AT&T, Regional Companies, or BELLCORE - the research, engineering, and technical services organization jointly owned by the divested Bell Operating Companies - may be obtained from Telcordia Technologies Customer

Service (Documentation), One Telcordia Drive, Piscataway, NJ 08854-4151, telephone (732) 699-5828.

Technical society and technical association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal agencies

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3. INTERFACE REQUIREMENTS

3.1 General Requirements

This IRD describes the Ground to Ground (G/G) communications interface requirements between the AVN and analog G/G telephone and voice switching equipment. The AVN analog G/G functional interface is depicted in Figure 3-1. Signaling and voice communications will occur over a full-time dedicated Point-to-Point (PTP) communications link provided as GFE. Communications links, all of which will be GFE, may include local copper to a PABX or the Public Switched Telephone Network (PSTN), a plain old telephone set (POTS), a channel bank or other telephone company multiplexer, or a GFE circuit to other FAA or non-FAA facilities.

Note: The vast majority of GFE circuits are currently provided through the Federal Aviation Administration (FAA) Telecommunications Infrastructure (FTI).

a. The AVN **must** intercommunicate by means of signaling through the NVS analog G/G interfaces and the required services of the FTI, when utilized.

b. The AVN **must** interface with G/G circuits in quantities to be defined at time of order by the Government.

c. The AVN **must** provide 2-wire and 4-wire interfaces in quantities to be defined at time of order by the Government.

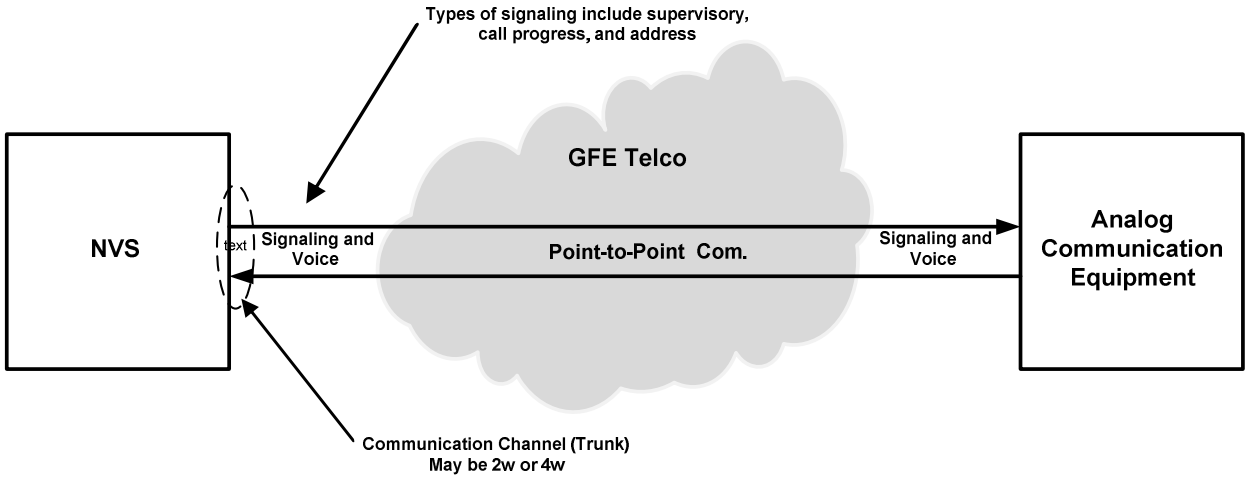

Figure 3-1 NVS to the Analog G/G Functional Interface

3.1.1 Administrative Telephone Service

a. The AVN **must** interface to the Government furnished administration telephone service in quantities to be defined at time of order by the Government.

Note: The AVN may be required to connect to administrative telephones (PABX, key system, etc.) or to public switched telephone network (PSTN) to place and receive calls.

3.1.2 Trunk Grouping

a. The AVN **must** provide trunk grouping and directionalization features for analog G/G circuits having supervisory signaling and either incoming, outgoing, or both address signaling as follows:

b. The AVN **must** use an idle line hunting algorithm that distributes outgoing calls evenly over all trunks in outgoing or two-way trunk groups.

c. The AVN **must** provide access to trunk groups via IA or DA procedures as defined in 3.1 of the NVS Spec.

d. The AVN **must** allow trunk grouping and classmark assignments to be set through the system expansion and physical reconfiguration procedures in 3.1.8 of the NVS Specification.

e. The AVN **must** support identical features for all trunks within a trunk group.

f. The AVN **must** allow trunk groups to be assigned for use with speed dialing as defined in 3.1.2.2.7.9 of the NVS Specification.

3.2 Interface requirements

3.2.1 Analog-type interface requirements

a. The AVN **must** meet interphone (I/P) requirements by generating signaling for call processing purposes.

b. The AVN **must** facilitate the two-way transfer of call processing signals between the AVN and analog telephone equipment.

3.2.1.1 Applicable Call Procedures

a. The AVN **must** place and accept override calls as described in 3.x.x of the NVS Specification.

b. The AVN **must** place and accept voice calls as described in 3.x.x of the NVS Specification.

c. The AVN **must** place and accept ringdown (non-selective) calls as described in 3.x.x of the NVS Specification.

d. The AVN **must** place and accept selective signaling calls as described in 3.x.x of the NVS Specification.

e. The AVN **must** place and accept dial repeating (PBX tie line) calls as described in 3.x.x of the NVS Specification.

f. The AVN **must** place and accept central office/PBX calls as described in 3.x.x of the NVS Specification.

g. The AVN **must** place and accept local dial calls as described in 3.x.x of the NVS Specification.

h. The AVN **must** provide trunk or circuit interfaces that follow the procedures defined in 3.1.2.3 of the NVS Specification for processing incoming and outgoing calls on analog circuits and trunks.

i. The AVN **must** provide trunk or circuit interfaces that follow one call procedure, as applicable and designated by authorized personnel.

j. The AVN **must** provide trunk or circuit interfaces that follow more than one call procedure, as applicable and designated by authorized personnel.

Note: In some cases, more than one call procedure is applicable to the trunk or circuit type. For example, some selective signaling circuits allow dial in and out, some allow voice detect in and dial out, and some allow dial in and either voice or dial out.

3.2.1.2 Signaling

The AVN **must** generate interface signaling to support both line and register signaling (i.e., supervisory, call progress, and address signaling) capabilities for the analog G/G interface.

3.2.1.2.1 Supervisory Signaling

a. The AVN **must** use supervisory signaling on each G/G analog interface as configured by authorized personnel.

b. The AVN **must** generate supervisory signaling to provide control forward (seize, hold, release) and status backward (idle, busy, disconnect) for the analog G/G interface.

c. The AVN **must** use Single Frequency (SF) and Loop signaling for supervisory signaling in accordance with TIA/EIA-464, paragraph 6.2 for the analog G/G interface.

d. The AVN **must** use the electrical characteristics of loop-start signaling as defined in AT&T PUB 43001 for the analog G/G interface.

e. The AVN **must** use the electrical characteristics of SF signaling as defined in AT&T PUB 43201 for the analog G/G interface.

Note: Use of incoming supervisory signaling is not required, or desired, on all interfaces, including those where it might normally be expected.

3.2.1.2.2 Audible call progress signaling

a. The AVN **must** use call process signaling on each analog G/G interface as configured by authorized personnel.

b. The AVN **must** use call progress signaling with frequency, power level, and interruption patterns in accordance with TIA/EIA-464, paragraph 6.3.

c. The AVN **must** use call progress signaling for selective signaling analog G/G interface as follows:

1. The AVN **must** provide DTMF as audible confirmation tone that digits are being outpulsed if the interface is configured as senderized.
2. The AVN **must** provide FSK as audible confirmation tone that digits are being outpulsed if the interface is configured as non-senderized.
3. The AVN **must** NOT provide busy tone.
4. The AVN **must** NOT provide audible ringback tone.

d. The AVN **must** permit authorized maintenance personnel to adjust the call progress signal levels heard by the operator +2 dB to -10 dB from the settings defined in section 7.3 of ANSI/TIA-464C, and this specification.

Note: Use of call progress signaling is not required, or desired, on all interfaces.

3.2.1.2.3 Address Signaling

a. The AVN **must** generate address signaling to be used for selecting the appropriate called position at the called facilities and identify the type of call (i.e., conference call, override call) for the analog G/G interface.

b. The AVN **must** use Dial Pulse (DP), Dual Tone Multi-Frequency (DTMF), and Selective Signaling (SS) for address signaling for the analog G/G interface.

3.2.1.2.4 Central Office Caller Identification

a. The AVN **must** provide means to decode and display Automatic Number Identification (ANI) that may be provided by the local central office on each circuit that is accessible via the public network.

b. The AVN **must** decode Calling Number Delivery (CND) and Calling Name Delivery (CNAM) from the local central office in accordance with Bellcore GR-181-CORE.

c. The AVN **must** accept either Single Data Message Format or Multiple Data Message Format data packets.

Note: The AVN need not support Caller ID on Call Waiting (CIDCW).

d. When the AVN receives a Single Data Message Format (SDMF) data packet from the central office containing the calling party number:

1. The AVN **must** display at an operational position the calling party ID number, and
2. The AVN **must** prohibit the display of the date and time of the call.

e. When the AVN receives a Multiple Data Message Format (MDMF) data packet from the central office:

1. The AVN **must** display at an operational position the calling party ID number;
2. The AVN **must** prohibit the display of the date and time of the call; and

3. The AVN **must** display reason for no calling party number/name when supplied by the terminating switch (e.g., unknown or private).

f. The AVN **must** withhold call notification to the operational position (e.g., chime the position) until the calling party ID has been received from the terminating switch or upon reception of the second ring cycle on those trunks classmarked to receive caller ID.

g. The AVN must provide an error message at the operational position if an invalid caller ID is received at the AVN.

3.2.1.2.5 Signaling interfaces with existing systems

a. The AVN **must** support the methods of signaling listed in Table 3-1 and Table 3-2 for the analog G/G interface for I/P operations.

Table 3-1 Incoming Analog Circuit Interface Types for I/P Communications

Audio Type	Incoming Signaling
2w	20 Hz Ring
2w	Loop
2w	Loop & DTMF
4w	20 Hz Ring
4w	Loop
4w	Loop & Dial
4w	Voice
4w	E-Lead
4w	E-Lead & Dial
4w	SF
4w	SF & Dial
4w	Selective Signaling
4w	DTMF

3.2.1.2.6 Incoming call signaling

a. The AVN **must** accept the incoming call signaling for the circuits and trunks in table 3-1 as configured by authorized personnel.

b. The AVN **must** accept any of the incoming call signaling procedures in combination with any of the outgoing call procedures of the same audio type.

3.2.1.2.6.1 20 Hz ring

The AVN **must** detect 20 Hz incoming ring voltage in accordance with 5.1.1.2.8 in ANSI/TIA-464C for ringing type A circuits.

3.2.1.2.6.2 Loop start detection

The AVN **must** recognize a resistance of 2450 ohms or less between tip and ring conductors at the interface as a circuit or trunk seizure.

3.2.1.2.6.3 Voice call signaling

a. The AVN **must** detect an incoming voice call by the presence of incoming voice signals on the line for the analog G/G interface.

b. The AVN **must** provide voice activated circuitry (VOX) to control voice connectivity based upon the magnitude of audio-frequency energy in the signal.

c. The AVN **must** ensure immediate activation of the circuit upon receipt of incoming voice without noticeable distortion or suppression of incoming speech.

d. The AVN **must** ensure the threshold of any VOX circuits used to control voice connectivity are sufficiently high to ensure that idle, spurious, or impulse noise will not activate the circuits.

e. The AVN **must** ensure the VOX circuits used to control incoming call indicators activate the indicator in the presence of audio, but not during periods of idle telephone circuit noise.

f. The AVN **must** exhibit a voice signaling threshold of -26 dBm0 (nominal test level) for the analog G/G interface.

g. The AVN **must** block responses to voice signals below the threshold of -26 dBm0 for the analog G/G interface.

h. The AVN **must** provide an adjustable VOX threshold, as configured on a line by line basis by authorized personnel, from -12 dB to +9 dB from the default setting.

3.2.1.2.6.4 E&M signaling (E-lead)

The AVN **must** detect Type I, Type II, and Type V E-lead closures, in accordance with paragraph Annex F3 in ANSI/TIA-464C, initiated at the distant end of the circuit or trunk.

3.2.1.2.6.5 Single Frequency (SF)

3.2.1.2.6.5.1 SF tone-on-idle

a. The AVN **must** interpret presence of tone as idle or on-hook.

b. The AVN **must** interpret loss of tone as line seize or off-hook.

c. The AVN **must** be configured on a line by line basis by authorized personnel to accept 2400 Hz signaling option.

d. The AVN **must** be configured on a line by line basis by authorized personnel to accept 2600 Hz signaling option.

e. The AVN **must** be configured on a line by line basis by authorized personnel to accept 2800 Hz signaling option.

f. For 2400 Hz operation, the AVN **must** accept as valid signal tone any signal single frequency tone within a 2400 ± 7 Hz band.

g. For 2600 Hz operation, the AVN **must** accept as valid signal tone any signal single frequency tone within a 2600 ± 15 Hz band.

h. For 2800 Hz operation, the AVN **must** accept as valid signal tone any signal single frequency tone within a 2800 ± 7 Hz band.

i. The AVN **must** have a tone detection threshold of -30 dBm0.

j. The AVN **must** accept a maximum tone of 0 dBm0.

k. The AVN **must** have a signal to guard ratio for tone detection of 9 ± 3dB.

Note: Signal to guard ratio is the strength of the SF received tone relative to the level of all other received audio. It is used to prevent talk-off where voice or other audio could be interpreted as a release signal.

l. The AVN **must** meet all signal detection requirements in the presence of a maximum line noise of 51 dBrnC0.

m. The AVN **must** declare a valid on-hook condition 33 ± 3 ms after receipt of a valid tone.

n. The AVN **must** declare a valid off-hook condition 60 ± 20 ms after loss of valid tone.

o. The AVN **must** insert a band elimination filter (BEF) in the receive audio path within 13 ± 7 ms of detection of a valid tone.

Note: The insertion of a band elimination filter prevents an operator from hearing any SF tone signaling.

p. The AVN **must** maintain the BEF connectivity for the duration of a valid tone.

q. The AVN **must** remove the BEF within 50 ± 5 ms after the tone ceases.

r. The AVN **must** provide BEF attenuation of tones between 2390 and 2410 Hz by a minimum of 50 dB for the 2400 Hz operational mode.

s. The AVN **must** provide BEF attenuation of tones between 2590 and 2610 Hz by a minimum of 50 dB for the 2600 Hz operational mode.

t. The AVN **must** provide BEF attenuation of tones between 2790 and 2810 Hz by a minimum of 50 dB for 2800 Hz operational mode.

3.2.1.2.6.5.2 SF tone-on-active

a. The AVN **must** interpret presence of tone as line seize or off-hook.

b. The AVN **must** interpret loss of tone as idle or on-hook.

c. The AVN **must** be configured on a line by line basis by authorized personnel to accept 2400 Hz signaling option.

d. The AVN **must** be configured on a line by line basis by authorized personnel to accept 2600 Hz signaling option.

e. The AVN **must** be configured on a line by line basis by authorized personnel to accept 2800 Hz signaling option.

f. For 2400 Hz operation, the AVN **must** accept as valid signal tone any signal single frequency tone within a 2400 ± 7 Hz band.

g. For 2600 Hz operation, the AVN **must** accept as valid signal tone any signal single frequency tone within a 2600 ± 15 Hz band.

h. For 2800 Hz operation, the AVN **must** accept as valid signal tone any signal single frequency tone within a 2800 ± 7 Hz band.

i. The AVN **must** have a tone detection threshold of -30 dBm0.

j. The AVN **must** accept a maximum tone of 0 dBm0.

k. The AVN **must** have a signal to guard tone detection ratio of 9 ± 3dB if a signal to guard detector is used.

Note: Signal to guard ratio is the strength of the SF received tone relative to the level of all other received audio. It is used to prevent talk-off where voice or other audio could be interpreted as a release signal.

l. The AVN must limit the guard detect bandwidth to frequencies above 500 Hz if a signal to guard detector is used.

Note: This is to prevent call progress tones from interfering with tone detection.

m. The AVN **must** meet all signal detection requirements in the presence of a maximum line noise of 51 dBrnC0.

n. The AVN **must** declare a valid off-hook condition after receipt of a valid tone for 260 ± 45 ms.

o. The AVN **must** declare a valid on-hook condition after loss of valid tone for 260 ± 45 ms.

p. The AVN **must** continually insert a band elimination filter (BEF) in the receive audio path.

Note: The insertion of a band elimination filter prevents an operator from hearing any SF tone signaling.

q. For 2400 Hz operation, the AVN BEF **must** attenuate tones between 2390 and 2410 Hz by a minimum of 50 dB

r. For 2600 Hz operation, the AVN BEF **must** attenuate tones between 2590 and 2610 Hz by a minimum of 50 dB.

s. For 2800 Hz operation, the AVN BEF **must** attenuate tones between 2790 and 2810 Hz by a minimum of 50 dB

3.2.1.2.6.6 Selective signaling

a. The AVN **must** use selective signaling in accordance with FAA-STD-054 for the analog G/G interface.

b. The AVN **must** accept selective signaling tone bursts transmitted from the distant end of the circuit or trunk.

c. The AVN **must** detect selective signaling tones from the distant end of the circuit or trunk in accordance with requirements defined in FAA-STD-054 Table 3-2, Signaling Tolerances.

d. The AVN **must** receive and process two and three digit address signaling provided by the circuit or trunk.

e. The AVN **must** permit authorized personnel to classmark each SS interface whether to decode the digit "1" received as an address digit or as a clearing digit.

f. The AVN **must** permit authorized personnel to enable, for any interface, on-premises dialing capability as defined in 3.5.1.6 of FAA-STD-054.

g. The AVN **must** permit authorized personnel to disable, for any interface, on-premises dialing capability as defined in 3.5.1.6 of FAA-STD-054.

h. The AVN **must** disable broadcast code use as defined in 3.5.1.5 of FAA-STD-054.

3.2.1.2.6.7 Ring trip detection

The AVN **must** detect call answer in presence of outgoing ring per 3.2.1.2.7.1 of this IRD in accordance with paragraph 5.4.4 of ANSI/TIA-464C.

3.2.1.2.6.8 Receiving address signaling

The AVN **must** receive and process address signaling provided by trunks and circuits in accordance with the following and as ordered by the Government:

a. The AVN **must** accept dual tone multi frequency (DTMF) address signaling in accordance with paragraph 7.1.5 in ANSI/TIA-464C.

b. The AVN **must** accept dial pulse address signaling from the following interfaces:

   1. Loop start (telephone) and CO/PABX– Accept dial pulse digits from the meeting requirements in Annex E3 in ANSI/TIA-464C;

   2. E&M–Accept dial pulse address digits from E&M interfaces in accordance with Annex E4.2 in ANSI/TIA-464C;

   3. Tone on idle SF–Accept dial pulse digits from SF interfaces in accordance with E&M procedures defined in 3.2.1.3.1 of this IRD, where E-lead active (off-hook) is absence of tone, and E-lead release (on-hook) is presence of tone; and

4. Tone on active SF–Accept dial pulse digits from SF interfaces in accordance with E&M procedures defined in 3.2.1.3.2 of this IRD, where E-lead active (off-hook) is presence of tone, and E-lead release (on-hook) is absence of tone.

Table 3-2 Outgoing Analog Circuit Interface Types for I/P Communications

Audio Type	Outgoing Service
2w	20 Hz Ring
2w	Loop
2w	Loop & DTMF
4w	20 Hz Ring
4w	Loop
4w	Loop & DTMF
4w	Voice
4w	M-Lead
4w	M-Lead & DTMF
4w	SF
4w	SF & DTMF
4w	Selective Signaling
4w	DTMF

3.2.1.2.7 Outgoing call signaling

a. The AVN **must** initiate the outgoing call signaling for the circuits and trunks in table 3-2 as configured by authorized personnel.

b. The AVN **must** accept any of the incoming call signaling procedures in combination with any of the outgoing call procedures of the same audio type.

3.2.1.2.7.1 20 Hz ring

a. The AVN **must** provide 20 Hz outgoing ring voltage between 75 to 100 V rms, with a terminating impedance of 8000/N ohms (as designated by the Government) upon seizure of the idle circuit by the operator.

Note: N = number of station ringer equivalence with which the AVN is designed to work.

b. AVN automatic ringing **must** comply with the provisions of 5.4.3.1 in ANSI/TIA-464C.

3.2.1.2.7.2 Loop start detection

The AVN **must** initiate loop start upon seizure of the idle circuit by the operator in accordance with 5.1.2.4 in ANSI/TIA-464C.

3.2.1.2.7.3 Voice call signaling

a. The AVN **must** seize (open) any circuit designated by the Government as a voice call line when the operator activates the line by operating a selector designated for the circuit.

b. The AVN **must** transmit the voice from the operator's position microphone into the circuit whenever the circuit has been activated by the operator.

3.2.1.2.7.4 E&M signaling (M-lead)

The AVN **must** initiate Type I, Type II, and Type V M-lead closure as defined in Annex F.3 in ANSI/TIA-464C.

3.2.1.2.7.5 SF

3.2.1.2.7.5.1 SF tone-on-idle

a. The AVN **must** interpret idle as sending tone.

b. The AVN **must** interpret busy as no tone transmitted.

c. The AVN **must** be configured on a line by line basis by authorized personnel to provide 2400 Hz signaling option.

d. The AVN **must** be configured on a line by line basis by authorized personnel to provide 2600 Hz signaling option.

e. The AVN **must** be configured on a line by line basis by authorized personnel to provide 2800 Hz signaling option.

f. The AVN **must** provide a 2400 ± 2Hz SF tone for the 2400 Hz operational mode.

g. The AVN **must** provide a 2600 ± 2Hz SF tone for the 2600 Hz operational mode.

h. The AVN **must** provide a 2800 ± 2Hz SF tone for the 2800 Hz operational mode.

i. The AVN **must** transmit at a nominal -20 dBm0.

j. The AVN **must** permit authorized personnel to adjust the transmit tone from -10 to -30 dBm0 without impacting the transmit voice level.

k. The AVN **must** cut transmit audio to the line 18 ± 5 ms before transmission of SF tone.

l. The AVN **must** restore transmit audio to line 18 ± 5 ms before stopping transmitted SFtone.

m. The AVN **must** restore transmit audio within 125 ± 50 ms after receiving a valid off hook signal if the transmit audio has not been restored after the transmission of SF tone.

Note: The path cut removes any possible speech audio to the line so the SF detector at the far end can detect a clear release state.

3.2.1.2.7.5.2 SF tone-on-active

a. The AVN **must** interpret idle as no tone transmitted.

b. The AVN **must** interpret busy as sending tone.

c. The AVN **must** be configured on a line by line basis by authorized personnel to provide 2400 Hz signaling option.

d. The AVN **must** be configured on a line by line basis by authorized personnel to provide 2600 Hz signaling option.

e. The AVN **must** be configured on a line by line basis by authorized personnel to provide 2800 Hz signaling option.

f. The AVN **must** provide a 2400 ± 2Hz SF tone for the 2400 Hz operational mode.

g. The AVN **must** provide a 2600 ± 2Hz SF tone for the 2600 Hz operational mode.

h. The AVN **must** provide a 2800 ± 2Hz SF tone for the 2800 Hz operational mode.

i. The AVN **must** transmit at a nominal -20 dBm0.

j. The AVN **must** permit authorized personnel to adjust the transmit tone from -10 to -30 dBm0 without impacting the transmit voice level.

3.2.1.2.7.6 Selective signaling

a. The AVN **must** provide SS-4 selective signaling tones to the analog trunk interface corresponding to station numbers dialed by the operator, meeting the requirements in Table 3-2 of FAA-STD-054.

b. The AVN **must** permit authorized personnel to adjust the standard FSK tone levels specified in FAA-STD-054, Table 3-2 from +5 dB to -12 dB.

c. The AVN **must** accommodate both 2 and 3 digit address dialing on the same SS circuit.

d. The AVN **must** mute any position transmit audio output on the SS circuit from the instant the first digit is sent out from the interface to the time the last digit is sent from the interface, or until six seconds have elapsed from sending the last digit entered by the position operator.

e. The AVN **must** permit authorized personnel to classmark each SS interface whether to send a digit “1” (e.g., the clearing digit) prior to sending any address digits entered by the position operator or not to send a digit “1”.

f. The AVN **must** permit authorized personnel to classmark each SS interface for senderized operation for outgoing dial digits.

g. The AVN **must** permit authorized personnel to classmark each SS interface for non-senderized operation for outgoing dial digits.

h. The AVN **must** provide SS circuits with cut-through operation so the user can voice page the far end.

3.2.1.2.7.7 Sending address signaling

The AVN **must** send address signaling to trunks and circuits in accordance with the following and as ordered by the government:

a. The AVN **must** send dual tone multi frequency (DTMF) address signaling to trunks and circuits in accordance with 7.1.4 in ANSI/TIA-464C.

b. The AVN **must** generate dial pulse address signaling into the following interfaces:

   1. The AVN **must** provide dial pulse address signaling to the line or trunk in accordance with Annex E2 of TIA-464C for Loop start and ground start interfaces.

   2. The AVN **must** send pulse address digits to E&M interfaces in accordance with Annex E4.1 in TIA-464C for E&M interfaces.

   3. The AVN **must** send dial pulses, where M-lead active (off-hook) is absence of tone, and M-lead release (on-hook) is presence of tone, to SF interfaces in accordance with E&M procedures defined in 3.2.1.2.7.5.1 of this IRD for SF Tone on idle interfaces.

   4. The AVN **must** send dial pulses, where M-lead active (off-hook) is presence of tone, and M-lead release (on-hook) is absence of tone, to SF interfaces in accordance with E&M procedures defined in 3.2.1.2.7.5.2 of this IRD for SF Tone on active interfaces.

3.2.1.3 Audio transmission requirements

3.2.1.3.1 Analog Presentation

a. The **AVN must** provide one-wire pair that is transformer coupled, balanced, and isolated from ground for the TX and RX interface to the 2w analog circuit.

b. The **AVN must** provide two-wire pairs that are transformer coupled, balanced, and isolated from ground for both the TX and RX interfaces to the 4w analog circuit.

c. The **AVN must** provide analog circuit interfaces with frequency response of 300 to 3,000 Hz +/- 1 dB to each analog circuit.

3.2.1.3.1.1 NVS-to-trunk requirements

For transmission from the NVS to analog trunks or circuits balanced to ground with ground isolation:

a. The AVN **must** provide a two-wire TX audio interface that is transformer coupled with an impedance of 600 ohms ± 10% to each two-wire and four-wire interface.

b. The AVN **must** provide an option for transformer coupled impedance of 900 ohms ± 10% for two-wire interfaces.

c. The AVN **must** transmit at the appropriate power level for the trunk or circuit.

d. The AVN **must** permit qualified government personnel to adjust each interface's output power level between +12 and -16 dB relative to the level at the zero transmission level point specified in the analog transmission plan.

3.2.1.3.1.2 Trunk-to-NVS requirements

For transmission to the AVN from analog trunks or circuits balanced to ground with ground isolation:

a. The AVN **must** provide a two-wire RX Audio interface that is transformer coupled with an impedance of 600 ohms ± 10% for two-wire and four-wire interfaces;

b. The AVN **must** provide an option for transformer coupled impedance of 900 ohms ± 10% for two-wire interfaces;

c. The AVN **must** receive at the appropriate power level for the analog trunk or circuit.

d. For site adaptation, the AVN **must** permit qualified government personnel to adjust each analog trunk/circuit input power level between +12 and -16 dB relative to the level at the zero transmission level point specified in the analog transmission plan.

Note: The AVN can support zero loss lines by means of the above adjustments.

3.2.1.3.1.3 VG-6 Interface

a. The AVN **must** accommodate analog interfaces with a nominal impedance of 600 ohms when measured at 1,004 Hertz (Hz) for the category VG-6 Interface.

b. The AVN **must** accommodate category VG-6 circuits connected to the SDPs by four wires, including a transmit pair and a receive pair.

c. AVN **must** accommodate the use of standard commercial connectors for category VG-6 interfaces.

d. The AVN **must** accommodate a zero transmission level point (0 TLP) SDP for transmitted and received signals for the VG-6 interfaces.

e. The AVN **must** transmit signals at the SDP that have a maximum power of -13 dBm as averaged over any three-second interval at the 0 TLP.

f. The AVN **must** accommodate the use of 32 Kbps Adaptive Differential Pulse Code Modulation (ADPCM) encoding techniques in accordance with ITU-T G.726 for the VG-6 interface.

3.2.1.3.2 Digital Presentation

For transmission to and from the NVS by 4w trunks or circuits that do not require separate discrete signaling (i.e., pass audio only):

3.2.1.3.2.1 T-1 Interface

The FTI supports five types of high speed digital T-1 interfaces to provide digital data transmissions between defined SDPs. The AVN will utilize three of the T-1 interface types; Fractional T-1 (F1), T1C-1536 and T1C-1544.

3.2.1.3.2.1.1 Fractional T-1 Interface (F1)

a. The AVN **must** support a Fractional T-1 (F1) interface that conforms to the requirements of ANSI T1.403-1999, except as otherwise specified herein.

b. The AVN **must** support the extended superframe (ESF) format per ANSI T1.403-1999 at the SDP for F1 interfaces.

c. The AVN **must** support twenty-four, clear channel DS-0 signals of 64 kbps each provided at the SDP for F1 interfaces.

d. The AVN **must** accommodate synchronization with the F1 interface in accordance with the requirements of GR-436-CORE.

e. The AVN **must** support clear channel capability using bipolar with eight-zero substitution (B8ZS) line coding in accordance with ANSI T1.403 for the F1 interface.

f. The AVN **must** support a digital signal that is not constrained by "ones density" and number of consecutive zero requirements for the F1 interface.

Note: Robbed bit signaling capability on the ESF frames are made available for the Government's use for the F1 interface.

3.2.1.3.2.1.2 T1C-1536 Interface

The T1C-1536 interface provides a digital signal rate of 1536 kbps.

a. The AVN **must** support a T1C-1536 interface that conforms to the requirements of ANSI T1.403-1999, except as otherwise specified herein.

b. The AVN **must** support the extended superframe (ESF) format per ANSI T1.403-1999 at the SDP for T1C-1536 interfaces.

c. The AVN **must** support twenty-four, clear channel DS-0 signals of 64 kbps each provided at the SDP for T1C-1536 interfaces.

d. The AVN **must** accommodate synchronization with the T1C-1536 interface in accordance with the requirements of GR-436-CORE.

e. The AVN **must** support clear channel capability using bipolar with eight-zero substitution (B8ZS) line coding in accordance with section 8.1 of ANSI T1.403 for the T1C-1536 interface.

f. The AVN **must** support a digital signal that is not constrained by "ones density" and number of consecutive zero requirements for the T1C-1536 interface.

3.2.1.3.2.1.3 T1C-1544 Interface

The T1-1544 interface provides a digital signal rate of 1544 kbps in a channelized format yielding 24 clear-channel DS-0 signals with overhead for framing, alarm signaling, and digital order wire functions

a. The AVN **must** support a T1-1544 interface that conforms to the requirements of ANSI T1.403-1999, except as otherwise specified herein.

b. The AVN **must** support the extended superframe (ESF) format per section 7.4 of ANSI T1.403-1999 at the SDP for T1-1544 interfaces.

c. The AVN **must** accommodate transporting the entire ESF signal (i.e. framing bits) end-to-end over the transport path regardless of whether terrestrial or satellite media is used for T1-1544 interfaces.

d. The AVN **must** support twenty-four, clear channel DS-0 signals of 64 kbps each and one 8 kbps circuit of F Bits, provided at the SDP for T1-1544interfaces.

e. The AVN **must** accommodate synchronization with the T1-1544 interface in accordance with the requirements of GR-436-CORE.

f. The AVN **must** support clear channel capability using bipolar with eight-zero substitution (B8ZS) line coding in accordance with section 8.1 of ANSI T1.403 for the T1-1544 interface.

g. The AVN **must** support a digital signal that is not constrained by "ones density" and number of consecutive zero requirements for the T1-1544 interface.

Note: Robbed bit signaling capability on the ESF frames are made available for the Government's use for the T1-1544 interface. The FDL portion of the F Bits will be used by the Government. FTI will not use the 4 kbps FDL portion of the ESF signal for transmittal of alarm information.

3.2.1.3.2.2 Asymmetric T1 Interfaces

The FTI provides Asymmetric T1 Interfaces. The asymmetric T1 interface supports the aggregation, within the FTI network, of multiple discrete VG or DS0 requirements at individual Service Delivery Points (SDP) into a common delivery location involving a single T1 interface having multiple SDPs. Both Point-to-Point (PtP) and MultiPoint (MP) aggregated services are provided.

3.2.1.3.2.2.1 Point to Point Asymmetric T1 Interface Service – APT1

The APT1 Asymmetric T1 Interface supports point to point services. Specifically, this interface enables the assignment of an analog Voice Grade - 6 (VG-6) or digital DS0 channel(s) within a Fractional T1 (F1) service at one or more locations to a specific DS0 time slot(s) within a specific T1 interface involving multiple SDPs.

a. The AVN **must** accommodate the assignment of a VG-6 or DS0 channel(s) within a F1 service to a specific DS0 time slot(s) on a specific T1 interface (T1C-1536 or T1-1544) for APT1 interfaces. This channel assignment establishes an APT1 Asymmetric T1 Interface.

b. The AVN **must** accommodate services at the APT1 SDP that conform to the requirements for channelized services as stated in Section 3.2.1.3.2.1 of this document.

c. The AVN **must** support conformance to the requirements stated in Section 3.2.1.3.1.3 of this document for APT1 interfaces at a VG-6 SDPs.

d. The AVN **must** support conformance to the requirements stated in Section 3.2.1.3.1 of this document for switched analog APT1 interfaces at a VG-6 SDPs.

e. The AVN **must** conform to the requirements in section 3.2.1.3.2.1.1 of this document for APT1 interfaces associated with one or more digital DS0 channels within an F1 SDP.

f. The AVN **must** support the 64 kbps μ-law PCM standard as defined in ITU-T G.711 "Pulse code modulation (PCM) of voice frequencies" for APT1 interfaces.

3.2.1.3.2.2.2 MultiPoint Asymmetric T1 Interface Service – AMT1

The FTI provides AMT1 Asymmetric T1 Interfaces. The AMT1 Asymmetric T1 Interface supports the aggregation of voice MultiPoint (conference bridge) services. For example, this interface enables the assignment of a port (leg) on a voice conference bridge to a specific DS0 time slot within a T-1 interface involving multiple SDPs.

a. The AVN **must** accommodate the assignment of a voice MultiPoint service leg, designated by the MultiPoint USI (including segment number), to a specific DS0 time slot on a single T1 interface. Assignment of the MultiPoint service leg establishes an AMT1 Asymmetric T1 Interface. Up to 24 AMT1 interface services may be assigned to a single T1 interface.

b. The AVN **must** accommodate services at the AMT1 SDP that conform to the requirements for channelized services as stated in Section 3.2.1.3.2.1 of this document.

c. The AVN **must** support conformance to the requirements stated in Section 3.2.1.3.1.3 of this document for analog VG-6 services at AMT1 SDPs.

d. The AVN **must** conform to the requirements in section 3.2.1.3.2.1.1 of this document for AMT1 interfaces associated with one or more digital DS0 channels within an F1 SDP.

e. The AVN **must** support the 64 kbps μ-law PCM standard as defined in ITU-T G.711 "Pulse code modulation (PCM) of voice frequencies" for AMT1 interfaces.

3.3 Physical requirements

3.3.1 Mechanical requirements

3.3.1.1 Installation

3.3.1.1.1 Interchangeability

Not applicable.

3.3.1.1.2 Surface finish

Not applicable.

3.3.1.1.3 Location and orientation

Not applicable.

3.3.1.1.4 Holes

Not applicable.

3.3.1.1.5 Fasteners

Not applicable.

3.3.1.1.6 Bonding

Not applicable.

3.3.1.1.7 Weight and center of gravity

Not applicable.

3.3.1.1.8 Materials

Not applicable.

3.3.1.1.9 Markings

Not applicable.

3.3.1.2 Connectors

Not applicable.

3.3.1.3 Fluids (gases and liquids)

Not applicable.

3.3.1.4 Transportation and handling

Not applicable.

3.3.2 Electrical power/electronic requirements

Figure 3-2 illustrates how the End to End voice and signaling interface is defined by this IRD.

a. The AVN **must** implement the analog voice switch functional interface via the AVN to the FTI physical interfaces as depicted in Figure 3-2.

b. The AVN **must** meet the FTI electrical/electronic interface requirements as specified herein:

   1) Standard voice channel (four-wire)

      a. Transmit level: Zero transmission Level (0TL).

      b. Receive level: 0TL.

   2) Impedance

      a. Four–wire Circuits: 600 ohms +/– 20%

      b. Two–wire Circuits: 600 or 900 ohms +/– 20%

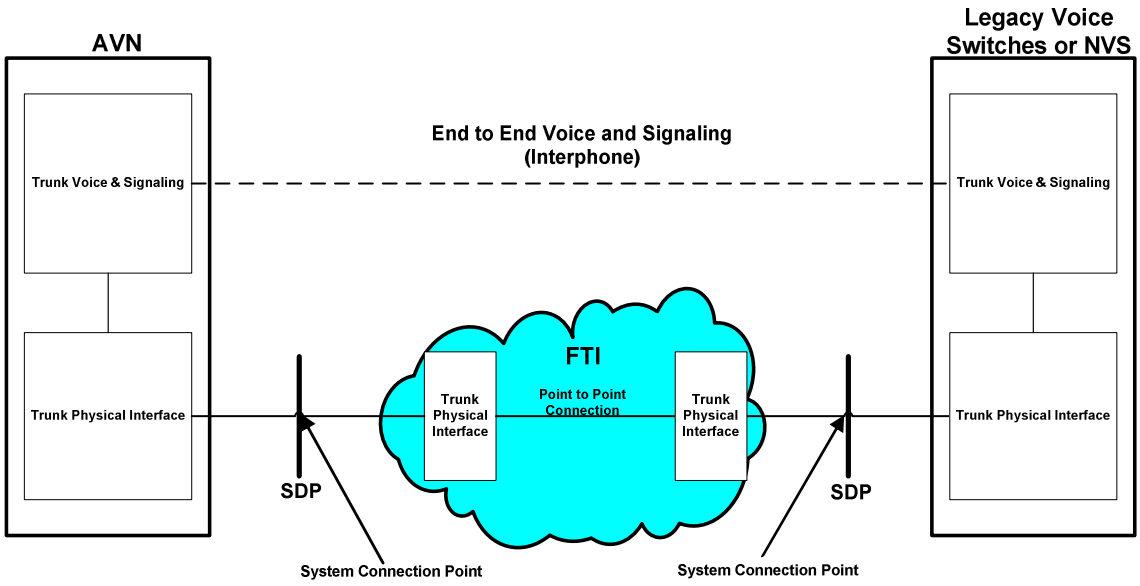

Figure 3-2 AVN to Physical Interfaces

3.3.2.1 Electrical/electronic block diagrams

Electrical/electronic block diagrams are not used to impose requirements in this IRD.

3.3.2.2 System description

The AVN **must** provide, via FTI and other GFE and non-GFE telephone connectivity, transmission and signaling compatibility between Voice Switches for the analog G/G interface.

3.3.2.3 Schematics

Schematics are not used to impose requirements in this IRD.

3.3.2.4 Interface wiring diagrams

Interface wiring diagrams are not used to impose requirements in this IRD.

3.3.2.5 Connectors

TBD

4. QUALITY ASSURANCE PROVISIONS

Compliance with the requirements stated in this IRD are deemed met when all the requirements specified in a paragraph are verified by one or more of the methods outlined in the subsequent subparagraphs. The results of the verification activities shall be expressed as either pass or fail.

4.1 General

Interface requirements imposed by section 3 of this IRD shall be verified by use of the verification methods specified in paragraph 4.4 and at the verification levels (phases) specified in paragraph 4.5. Verification methods and levels shall be applied in accordance with Table 4-1, Verification Requirements Traceability Matrix (VRTM).

4.2 Responsibility for verification

The program manager for the less mature voice switch has the responsibility for the interface requirements verification. The program manager for the more mature voice switch will assist in the verification.

4.3 Special verification requirements

This IRD imposes no special test equipment requirements.

4.4 Verification requirements traceability matrix

Verification shall be in accordance with Table 4-1, Verification Requirements Traceability Matrix (VRTM).

Table 4-1 Verification Requirements Traceability Matrix

(Verification Methods: D - Demonstration, I - Inspection, A - Analysis, T - Test, X - Not Applicable)

Section 3	Requirements	Verification Phase and Method			
		Subsystem Level	Integration Level	Site Level	Remarks

4.5 Verification levels and methods

The levels and methods of verification appropriate for use in the VRTM, presented in Section 4 of the IRD, are defined in the following paragraphs.

4.5.1 Verification levels

There are three verification levels that can be used during the verification process. Verification levels are:

a. Subsystem Level. This level of verification is usually accomplished at the contractor's facility and culminates in the formal acceptance of a contractual end-item.

b. Integration-level. This level of verification is conducted at the FAA Technical Center (FAATC), or at a key site. The verification conducted will determine if the hardware, software, or subsystem to be deployed for site installation will perform in a NAS environment and in accordance with NAS system-level operational and functional requirements.

c. Site-level. This level of verification is usually performed at the designated site. The verification portion of the subsystem installation and checkout will emphasize demonstration of the overall system performance requirements. It includes the demonstration of an end-item, subsystem and/or system, the final acceptance demonstrations, and commissioning activities.

4.5.2 Verification methods

There are four verification methods that can be used at any of the three verification levels. Verification methods are:

a. Inspection. Inspection is a method of verification to determine compliance without the use of special test equipment, procedures, or services, and consist of a non-destructive static-state examination of the hardware, software, and/or the technical data and documentation.

b. Test. Test is a method of verification wherein performance is measured during or after the controlled application of functional and/or environmental stimuli. Quantitative measurements are analyzed to determine the degree of compliance to the success criteria stipulated in the IRD or project specification. The process uses standardized laboratory equipment, procedures, hardware, and/or services.

c. Demonstration. Demonstration is a method of verification where qualitative determination of properties is made for configuration items, including software, and/or technical data and documentation measured, in a dynamic state.

d. Analysis. This method of verification consists of comparing hardware or software design with known scientific and technical principles, procedures, and practices to estimate the capability of the proposed design to meet the mission and system requirements. When certain elements of design are comprised of previously qualified elements such as commercial off the shelf (COTS) equipment, then analysis of previous qualification

testing in meeting specification requirements may be used to reduce the amount of qualification testing.

5. PREPARATION FOR DELIVERY

This section is not applicable to this IRD.

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6. NOTES

This section is used to describe the unique operational concept and provide additional detail to aid in understanding the NVS to the analog interface.

6.1 Definitions

Definitions of significant terms in this document follow:

Address signaling: Address signaling (also known as "register signaling") typically represents the digits dialed (i.e., the called number of the party). There are two options used in order to pass address information. Either Pulse dial (e.g., rotary dialing) or Tone dial (DTMF) can be used.

Analog interface: A customized or specialized interface between two systems or **subsystem**s that uses **analog signal**s to transmit information**.**

Analog signal: A nominally continuous electrical signal that varies in amplitude and / or phase frequency in response to changes in some quantity. Example: Microwave Communication, Primary Radar**.**

Automatic ring: Automatic ring refers to the provision of ring signaling on an interface when the user goes off-hook without requiring separate action by the user to apply the ring signal. Conversely, manual ring, as the name implies, requires the user to access the circuit and then apply the ring manually.

Automatic select:

Central office: The term "central office" refers to the building that houses the telephone exchange or Public Branch Exchange (PBX) on the Public Switched Telephone Network (PSTN).

CO/PBX line: For CO/PBX extensions (type 6), the incoming calls are non-selective and are directed to a position or a group of positions. Outgoing calls are selective and placed by accessing the trunk and then dialing additional digits. This interface is used for direct connection to either a Central Office or PBX as a station circuit and is also known as a Foreign eXchange Office (FXO) interface.

dB: The decibel, or dB**,** is a logarithmic unit that indicates the ratio of a physical quantity (usually power or intensity) relative to a specified or implied reference level. A decibel is literally one tenth of a Bel, which was named after Alexander Graham Bell. A dB is a ratio of two measurements and is therefore a dimensionless unit.

dBm: The dBm is an abbreviation for the ratio of power referenced to one milliwatt Since it is referenced to an absolute, the dBm is not a relative value like the dB (i.e., it is an absolute measure of power and has a unit). Zero dBm equals one milliwatt of power, -10 dBm equals 100 microwatts, and -20 dBm equals 10 microwatts.

dBm0: A logarithmic measure of power (in dBm) at the Zero Transmission Level Point (0TLP) to produce the same power in dBm at another point in the circuit using a 1.0 KHz tone.

Dial pulse, **pulse dialing**, or **loop disconnect dialing** (also called **rotary):** Pulsing in which a direct-current pulse train is produced by interrupting a steady signal according to a fixed or formatted code for each digit and at a standard pulse repetition rate. Dial pulsing originated with a rotary dial integrated into telephone instruments, for the purpose of signaling. Subsequent applications use electromechanical or electronic circuits to generate dial pulses. Pulse dialing is also possible using timed tone bursts with in-band SF signaling.

Dial repeating line: This circuit is used for Point-to-Point dial repeating signaling. These circuits transmit dual tone multi-frequency address signals, are selective both inbound and outbound, and support Voice Switch call processing and line supervision. This type of circuit is used to connect two voice switches where the switches operate like PBX systems and is sometimes referred to as a "PBX Tie Line".

Dual Tone Multi-Frequency *(*DTMF): The set of standardized, superimposed tones used in telephony signaling as generated by a touch tone pad**.**

Duplex Signaling (DX): Duplex signaling uses DC current flow to extend the range of E&M signaling. Components using DX signaling communicate with other DX components, forming a balanced bridge arrangement between the two components. A "referenced lead" is used to compensate for ground or battery potential differences between the circuits joined by the DX components. A "signaling lead" is used to signal either end of the circuit. The signaling lead voltage varies as a result of idle or busy states at each end. Both 2w and 4w interfaces are supportable.

Immediate dial (or start): This is the most basic protocol. In this technique, the originating switch goes off hook, waits for a finite period of time (for example, 200 ms), then sends the dial digits to the far end.

In-band signaling: An in-band signal is an analog signal in the 300 Hz to 3000 Hz voice band range. Typical in-band signals are 2400 Hz Single Frequency (SF) and 2600 Hz SF, although 2800 Hz is sometimes encountered.

Interface: A Common functional and/or physical boundary where hardware/software interacts.

Interface Control Document (ICD): The ICD is a formal agreement which documents how the interface requirements are implemented for interfaces between subsystems or a subsystem and its supporting facility. The purpose of an ICD is to control implementation of interface design requirements.

Interface requirements document (IRD): The IRD is a formal agreement which establishes design requirements for interfaces between subsystems or a subsystem and its supporting facility. The purpose of an IRD is to impose interface design requirements.

Interphone (I/P): FAA interfacility ground-to-ground voice communications.

Local dial line: Local dial lines (type 8) are point-to-point, non-selective outbound, selective inbound circuits. For outbound calls, no selectivity is available. Inbound calls can be directed

to individual positions based on the address provided by the distant end. This type of circuit allows the voice switch to emulate the central office and connect directly to a telephone set to allow a user to dial individual positions. An inbound address table must be defined.

National Airspace System (NAS): The common network of U.S. airspace; air navigation facilities, equipment and services, airports or landing areas.

Non-selective: This term refers to point to point communications where no address signaling is required or provided. No ability to selectively call a position on the circuit is provided..

PBX tie line: PBX tie lines (type 7) are selective in both directions. Incoming calls are directed only to the position addressed. Outgoing calls are placed by accessing the trunk and then dialing additional digits, as required. This type of interface is used to connect two PBXs.

Ringdown (non-selective) line: Ringdown lines (type 3) are non-selective point-to-point circuits. These circuits are typically configured for automatic ring, which means the call request is sent upon seizure of the circuit without separate action by the user. A manual ring feature has also been available in the past that would allow a user to re-ring the called party. On 2w circuits, the off-hook condition for outbound calls and call request for inbound calls results in either a loop closure (detected by a PBX at the far end of the circuit) or by the administration of a locally generated 20 Hz ring voltage to the line. For 4w circuits, the off-hook condition for outbound calls and call request for inbound calls is usually presented as an in-band SF tone (or the lack thereof). Out-of-band signaling (e.g., E&M) can also be used to support ringdown calls.

Selective signaling line: Selective Signaling lines (type 4, type 4/5, type 5) are multi-point and can support both 2 digit dialing (SS-1) and 3 digit dialing (SS-4). A call is placed by first accessing the trunk and then dialing the 2 or 3 digit facility address. Address signaling uses Frequency Shift Keying (FSK), which is a form of pulse dialing that alternates between 2600 Hz and 2400 Hz in-band SF tones. The "1" digit is sometimes used for addressing, but more commonly is used as a "clear register" signal to correct a dialing error. One or more legs of this circuit can use voice detect instead of SS signaling.

Signaling: With respect to telephone switching systems, the transmission of address and other switching information between stations and central offices, stations and switching entities, and between switching entities.

Simplex Signaling (SX): Simplex signaling is signaling where two conductors are used for a single channel, and a center-tapped coil, or its equivalent, is used to split the signaling current equally between the two conductors. The return path for the current is through ground. It is distinct from a phantom circuit in which the return current path for power or signaling is provided through different signal conductors. SX signaling may be one-way, for intra-central-office use, or the simplex legs may be connected to form full duplex signaling circuits that function like composite (CX) signaling circuits with E&M lead control.

Single-frequency (**SF**) **signaling:** Line signaling (in telephony) in which dial pulses or supervisory signals are conveyed by a single voice-frequency tone in each direction. SF and similar systems were used in 20th century carrier systems.

Subsystems: A grouping of one or more equipment items that is a relatively independent, identifiable entity.

Timed Immediate Start

Transmission Level (TL): The numeric value of a TL is the ratio (in dB) of the power of a signal at that point to the power of the same signal at the reference point "0TLP".

Trunk: A communication channel between two switching systems. A two-wire or four-wire circuit that can be a leased or a Government-owned transmission facility connecting the NVS with legacy analog switches, external, or remote equipment. The trunk will normally include the protection and isolation equipment when leased facilities are used. A trunk is switch-connected at both ends.

Voice call line: Voice call lines (type 9) are typically used for four-wire, point-to-point, two-way voice calls. A Voice detect (VOX) circuit is used on the receive pair to detect incoming audio and signal the voice switch. No signaling is used on the transmit pair. These calls are sometimes configured on 2w circuits.

Wink start: Wink is the most commonly used protocol. In this technique, the originating switch goes off−hook, waits for a temporary off−hook pulse from the other end (which is interpreted as an indication to proceed), then sends the dial digits.

6.2 Abbreviations and acronyms

Definitions of abbreviations and acronyms peculiar to this document follow:

0TLP	Zero Transmission Level Point
dB	Decibel
dBm	Decibel referenced to 1 milliwatt
dBm0	Decibel referenced to 1 milliwatt, referenced to 0 Transmission Level Point
DP	Dial Pulse
DTMF	Dual Tone Multi-Frequency
FAA	Federal Aviation Administration
FTI	FAA Telecommunications Infrastructure
FTSD	FAA Telecommunications Services Description
G/G	Ground-to-Ground
Hz	Hertz
I/P	Interphone
ICD	Interface Control Document
IRD	Interface Requirements Document
ISO	International Organization for Standardization

KHz	Kilohertz
MF	Multi-Frequency
NAS	National Airspace System
NVS	NAS Voice System
OSI	Open Systems Interconnection
PBX	Private Branch Exchange
PTP	Point-to-Point
SDP	Service Delivery Point
SF	Single Frequency
SS	Selective Signaling
TIA/EIA	Telecommunications Industry Association / Electronic Industries Association
TL	Transmission Level
TVS	Terminal Voice Switch
VRTM	Verification Requirements Traceability Matrix
VSCS	Voice Switching and Control System
WECO	Western Electric Company
X	Not applicable

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